



The Global Financial Crisis: European banks sponsoring ABCP conduits in the United States market

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Biographical Note

Marta Vasconcelos was born in Porto, Portugal, on July 20, 1990. She graduated in Economics from the School of Economics and Management of the University of Porto in July, 2013. Also in 2013, she applied for the Master in Finance Program, lectured at the same college. This dissertation project is the final work of the two years course.

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Abstract

Eight years after the start of the financial crisis, the most developed economies across the globe are still suffering from the effects of the economic downturn. More than a crunch in credit, derivatives, property or equity markets, the global financial crisis had become a general economic recession with cross-border effects on employment, national policy and social welfare.

This project analyzes the impact of the run in the ABCP market that started on August 9, 2007, on the stock return performance of European banks that were guaranteeing conduits' investment in the United States. We provide empirical evidence that those banking institutions were the most affected by the financial turmoil, since the beginning of the recession. Also, we determine that banks with higher conduit exposure and European banks sponsoring ABCP conduit vehicles in the US have received the largest loan amount from the Fed's Term Auction Facility (TAF) lending program, established on December 12, 2007.

Keywords: Asset-backed commercial paper (ABCP), Conduits, Term Auction Facility (TAF), European banks, United States

JEL Codes: G01, G21

Resumo

Oito anos após o início da crise financeira, as economias mais desenvolvidas do mundo continuam a sofrer as consequências negativas do declínio económico. Mais do que um choque nos mercados de crédito, derivados, imobiliário ou de capitais, a crise financeira foi uma verdadeira recessão económica com efeitos globais no emprego, política nacional e bem-estar social.

A presente dissertação analisa o impacto da “corrida” ao mercado de emissão de papel comercial com garantias (*asset-backed commercial paper*), com início a 9 de Agosto de 2007, nas rendibilidades dos bancos europeus que ofereciam garantias ao investimento em papel comercial. O estudo fornece evidência empírica de que os bancos europeus que administravam veículos de titularização nos Estados Unidos foram os mais afetados pela crise financeira. Determina ainda que tanto as instituições bancárias com maior exposição à emissão de papel comercial, como os bancos europeus que garantiam o investimento em papel comercial nos Estados Unidos, foram aqueles que receberam os maiores montantes de empréstimo através do programa *Term Auction Facility* (TAF) implementado pela Reserva Federal, a 12 de Dezembro de 2007.

Palavras-chave: Títulos garantidos por papel comercial, veículos de titularização, *Term Auction Facility* (TAF), bancos europeus, Estados Unidos da América

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1. Introduction

The 2007-2009 Financial Crisis, precipitated by the turmoil in the subprime mortgage-backed securities sector, was considered the most severe international economic catastrophe since the Great Depression, in 1929. More than a crunch in credit, derivatives, property or equity markets, the global financial crisis became a general economic recession with cross-border effects on employment, national policy and social welfare.

But how did the problems in the housing market, a relatively small part of the overall financial system, turned into such a profound worldwide recession? In fact, throughout recent years, asset price bubbles on real estate and stock exchanges were common to a large majority of financial crises. Severely inflated housing and stock values in Japan from 1985 to 1989, the massive real estate bubble on Thailand and Asian Countries in 1992-1997 or the DotCom distress, which covered the period from 1997 to 2000, were examples of rapid acceleration of asset prices and overheated economic activity. However, the fears for financial contagion, and the extension of the crises themselves, have never had the strength of 2007-2009.

The answer to this question is that the early downturn was actually focused on real banking; banks are central to operational and investment activities in companies, governments and even in providing credit to families, so, when facing insolvency, they can have serious impacts on the general economy and market functioning. Thus, and although the first signs of distress were shown in the housing market, the crisis had actually been brewing for a number of consecutive years in the global banking system, with risks, differently from what had happened in previous shocks, being fully shared by the industry.

For the past decades, traditional banking activities of granting and holding loans had been increasingly replaced by securitization agreements, and large banks had gradually become actual intermediaries between investors and borrowers, packaging and reselling

loans in the capital markets (Brunnermeier, 2008). Securitization was primarily a risk sharing process, allowing banks to place large portfolios of assets into off-balance sheet special purpose vehicles (SPVs), which funded their acquisitions by selling short-term debt and particularly asset-backed commercial paper (ABCP) – the most traditional form of short-term credit – to outside investors. The special purpose vehicles would then slice the portfolios into tranches with different seniority and offered interest rates, and finally issue asset-backed securities (ABS) in the market.

As in traditional bank runs, where customers tried en masse to withdraw their saving deposits, the 2007-2009 financial crisis was the result of a system-wide bank run on the intermediation shadow banking sector (Gorton and Metrick, 2012). Immediately after the housing bubble burst, with subprime owners being unable to meet their mortgage payments, investors became increasingly reluctant in rolling over asset-backed commercial paper and other forms of short-term credit, causing financial markets to collapse. Similarly to what happened with traditional banks, which financed their operations via short-term deposits, the financial intermediation system was exposed to large maturity mismatches, purchasing medium to long-term assets by issuing short-term debt (Brunnermeier, 2008). Thus, when investors started demanding exceptionally high yields for new ABCP and other short-term debt instruments, the special purpose vehicles established by banks had severe difficulties in repaying their creditors.

However, losses in the ABCP and other debt markets were not borne by third-party investors themselves, but by large banking institutions, instead. Contrarily to the usual purpose of securitization, banks were providing the special purpose vehicles with explicit credit and liquidity guarantees which created recourse back onto banking institutions' balance sheets. Acharya et al. (2013), analyzing the turmoil in the ABCP market, demonstrated that banks were setting up off balance sheet vehicles, not with the objective of minimizing risk, but instead of lowering their capital adequacy requirements. In the run up to the crisis, special purpose vehicles – or conduits, for ABCP investments – allowed banking institutions to increase their risk taking behavior, while maintaining compliance with regulatory weighted ratios. As they were guaranteeing conduits' investment, banks were required to pay off maturing ABCP in the event of a default.

We specifically focus on the run on the ABCP market that started in August, 2007, after the announcement of BNP Paribas, which suspended withdrawals from three of its investment funds. Asset-backed commercial paper was the most important form of short-term debt in the years preceding the financial crisis and a central funding mechanism for structured investment vehicles (Shleifer, 2010) and private-label assets in the United States (Krishnamurthy et al. 2014).

Following Acharya and Schnabl (2010), and using conduit data from Moody's Investors Service, we assess asset-backed commercial paper sponsorship for all commercial banks in the United States and other markets. We conclude that European banks were the largest administrators of ABCP conduit vehicles, concentrating 73 percent of their investments in the US market. In recent decades, European banks had heavily increased their cross-border positions in foreign assets, particularly investing in dollars in the United States. As noted in Acharya and Schnabl (2010) and Shin (2012), European banking institutions usually hedged their currency risk by issuing short-term debt in the US market. However, and even though they were protecting themselves against exchange rate fluctuations, European banks were exposed to important currency mismatches, by investing in a currency other than their owns.

Our work provides empirical evidence that European banks sponsoring conduit vehicles in the United States were the most affected by the financial crisis. When the turmoil in the ABCP market started, European banks were not able to increase dollar funding by as much as they needed. While US banks could turn to their domestic deposits' market or the Federal Home Bank Loans system (FHBL), as alternative sources of financing, European banks had to try to raise liquidity in the dollar-denominated wholesales market or by accessing local deposits and exchanging them into US dollars, at the prevailing rate of exchange.

We argue that European banks sponsoring ABCP investments in the US faced additional exposure to conduit activity because, in the event that their funding positions could not be rolled over, they had to repay their creditors in non-domestic currency. At the start of the financial crisis, when both the interbank and the foreign exchange markets were facing serious disruptions, European and other foreign bank sponsors

investing in the United States, obliged to secure alternative sources of funding in order to offset the losses in the ABCP market, were subjected to severe liquidity shortages, due to the differences in access to dollar funding.

We test for the impact of currency mismatches on the equity returns of European banks that were providing explicit guarantees to conduit activity in the United States. We focus our analysis on the narrow 3-day window period around the start of the financial crisis, on August 9, and find that European banks with US ABCP exposure were experiencing the lowest stock returns since the beginning of the ABCP turmoil. Our results are robust when controlling for bank-specific characteristics and when applied to the entire month of August, 2007, where the negative effect of the ABCP shock on European banks backing conduits' investment in the US is higher than the encountered for the three-day window period. Also, we find no statistical significance for the months prior to August, 2007, except for July (where the coefficient for our dummy variable is positive), suggesting that the weaker performance of European bank sponsors backing ABCP investments in the US was fueled by currency mismatches in conduit activity.

Finally, we present and describe the main conventional and unconventional policy measures set up by the Federal Reserve, in order to provide liquidity to financial institutions in distress. In fact, when the Fed's officials, following the implementation of the Dodd-Frank Act, were forced to release detailed information on the special aid programs used to respond to the recent financial crisis, the disclosures revealed the extension of the Fed's aid to banks operating in the US.

After December 12, 2007, branches of foreign banks located in the United States were able to borrow from the Term Auction Facility (TAF) Program. At the same time, and with the objective of further extending the international reach of the TAF, the Federal Reserve set up the Central Bank Liquidity Swap Lines Facility with fourteen foreign central banks. On March and September, 2008, at the time Bear Stearns and Lehman Brothers' collapsed, the Fed implemented the Term Securities Lending Facility (TSLF), the Primary Dealer Credit Facility (PDCF), the Asset-Backed Commercial Paper Money Mutual Fund Liquidity Facility (AMLF), the Commercial Paper Funding Facility (CPFF) and the Term Asset-Backed Loan Facility (TALF). Collectively, foreign banks

received 65 percent of the total loan amount made available by the Fed's special liquidity programs, with the European Central Bank, the Bank of England and the Swiss National Bank taking over 80, 9 and 5 percent, respectively, of the contracted US dollar swap agreements.

We particularly focus on the TAF lending program, the first amongst the large set of the liquidity facilities implemented by the Federal Reserve, since the start of the financial crisis. The Term Auction Facility, by guaranteeing perfect anonymity to all borrowing institutions in the program, provided a satisfactory alternative to Discount Window lending and was implemented when it became clear that the use of traditional monetary tools were not able to improve the overall economic conditions, following the ABCP shock.

We match TAF's bank-level data to information on conduit activity provided by Moody's Investors Service. We follow the view presented in Shin (2012), where the author argues that the European banks' use of the Term Auction Facility was an indicator of banking dollar shortages, since the beginning of the 2007 turmoil. We empirically test for that hypothesis and find both that banks with higher conduit exposure, as measured by the ratio between total ABCP outstanding and bank equity, and European banks sponsoring conduit vehicles in the United States have received the largest loan amounts through the TAF lending program. The conclusion is consistent with the results on our first regression analysis, which confirms that European commercial banks sponsoring conduit vehicles in the US were the most affected by the ABCP crisis that started on August 9, 2007.

The remainder of this paper is organized as follows. Section 2 introduces an overview on the most relevant studies in our topic of analysis and Section 3 explains the role of banking activity in the leading up to the 2007-2009 financial crisis. Section 4 provides for a characterization on the ABCP market, specifically analyzing European bank's exposure to US conduit activity and Section 5 describes the main conventional and unconventional policy tools established by the Federal Reserve since the ABCP shock. Section 6 presents data, methodology and results for our regression analyses and Section 7 summarizes the main conclusions of our work.

2. Literature Review

The fears for financial contagion had never had the strength of 2007. The global financial crisis was a general economic recession with cross-border effects on employment, national policy and social welfare, and was considered the most severe international economic catastrophe since the Great Depression, in 1929.

What developed in late 2007 and into 2008 was a systemic-wide bank run that took place in the shadow banking sector, where severe stoppages in short-term financing caused financial markets to collapse (Mishkin, 2010). Pozsar et al. (2010) provide for a comprehensive view on shadow banking, studying in detail its institutional features and economic role: the volume of credit intermediation amounted to 20 trillion dollars in the US, nearly twice the 11 trillion for the traditional banking system.

A number of recent studies have examined the importance of short-term debt runs in precipitating the credit crunch.

Hördahl and King (2008), Gorton (2009), Gorton and Metrick (2009, 2012) and Gorton et al. (2010) focus on the sudden drying up of liquidity in the repo market. Sale and repurchase agreements were responsible for funding securitized assets in the shadow banking system, allowing for ABS maturity transformation. Gorton and Metrick (2012) use a measure of counterparty risk to demonstrate that the panic of 2007-08 was effectively a run on repo and that the weakening of the subprime alone was not the strict cause of systemic problems. Shleifer (2010) discusses the propositions in Gorton and Metrick's (2012) work, arguing that there is no sustained reason for accepting withdrawals in repo market, rather than defaults on commercial paper, as the state-cause for systemic problems, this given the increased contraction in ABCP in the years preceding the recession.

Similarly to Shleifer (2010), also Krishnamurthy et al. (2014) question the importance of sale and repurchase agreements as a method for funding asset-backed securities and financial institutions, in general. Specifically, they found that repo transactions of

private-label ABS corresponded to a reduced amount of \$196 billion (or \$359 billion if repo extended against corporate bonds is included) when compared to the outstanding ABCP financing of 1,173 billion dollars. Schroth et al. (2014) have too looked at asset-backed commercial paper as a means for assessing the determinants of debt runs at the onset of the crisis, measuring its sensitivity against coordination failures, asset volatility and liquidity, maturity mismatches, leverage and guarantees' strength. Differently from past works, the authors introduce a structural estimation approach, empirically showing that ABCP yields may be utilized in forecasting debt runs.

Runs on ABCP programs are further documented in Covitz et al. (2009), Kacperczyk and Schnabl (2009) and Arteta et al. (2013). When the turmoil in the subprime mortgages sector unfolded, investors became increasingly reluctant in rolling-over ABCP, causing severe losses to commercial banks which were guaranteeing conduits' investments.

Also important was the run on money market funds that followed the bankruptcy of Lehman Brothers in September, 2008. Dwyer and Tkac (2009), McCabe (2010) and Baba et al. (2009) explain the main events that occurred in the US money market fund (MMF) industry, after the Reserve Primary Fund broke the buck on September 16, while Bengtsson (2013) concentrates in the developments for the MMF European sector.

Our paper is part of an extensive body of literature that studies the impacts of the ABCP shock on banking institutions during the financial crisis.

Acharya and Richardson (2009) and Acharya et al. (2013) center their studies on asset-backed commercial paper and present regulatory arbitrage, in the pre-crisis period, as the primary business in the financial sector. Commercial banks, subjected to capital-adequacy requirements, saw in securitization a possibility of placing assets in off-balance sheet ABCP conduit vehicles, avoiding maintaining costly cash buffers against them. However, because they secured the underlying credit to investors by providing explicit guarantees to conduit activity, banks ended up on holding the effective risk and were securitizing without transferring risks to outside investors. Acharya et al. (2013) empirically test for the regulatory arbitrage hypothesis, examining whether more capital

constrained banks were more likely to set up conduit vehicles. Also, they study guarantees' structure and its effect on conduits' ability to roll-over maturing ABCP and demonstrate that outside investors in the market did not suffer losses on conduit activity. Finally, they examine the impacts of conduit exposure on banking stock returns from August 8 to August 10, 2007, and conclude that commercial bank sponsors were the most negatively affected by the ABCP shock in the early stages of the recession.

In related work, Acharya and Schnabl (2010) show that the geography of the financial crisis was determined by the incentives of global banks in manufacturing high rating securities, through the establishing of asset-backed commercial paper conduits. They empirically demonstrate that commercial banks of countries in surplus became as exposed to the recession as the US and other deficit markets, and argue that global imbalances¹ fall short in justifying the extension of the early turmoil, since the production of risk-free assets had no direct correlation with countries' current accounts. As in Acharya et al. (2013), the authors test for the hypothesis that banks with larger conduit exposure were the most affected by the ABCP crisis. However, because they study cumulative stock returns for the entire month of August, 2007, rather than focusing on a shorter window event, the authors may be including in their analysis other variables with effects on bank performance, some of which correlated with conduit sponsorship. Lastly, and following their analysis on the geography of asset-backed commercial paper conduits, they suggest that European bank sponsors, as they were the largest conduit administrators in the United States, were exposed to significant dollar shortages in the beginning of the financial crisis.

Whereas several authors document the extent of the US dollar shortage, focusing on the difficulties for foreign banks in accessing US dollar funding in the period that followed the ABCP shock, they do not provide empirical evidence that they were the most affected by the ABCP run.

McGuire and Von Peter (2009) introduce a measure of the US dollar shortage, based on the maturity gap between US dollar-denominated claims and liabilities, and examine cross currency funding as the amount to which banks were investing in one currency but

¹ A pure global imbalances' theory argues that the increased excess savings in some markets, combined with current account deficits for other countries, can lead to severe financial sector distortions.

financing in another. The use of the foreign exchange swap market for European major banks was increasingly difficult when credit conditions tightened after the onset of the financial crisis. The authors analyze banks' funding risk through their measure of the US funding gap, considering country-level data from BIS² international statistics.

Ivashina et al. (2012), although focusing on the period from May 2011, to June 2012, also stress out the importance of the foreign exchange swap market for foreign banks investing in the US. They show that, in the presence of heightened market credit concerns and limited arbitrage, a surge in the demand for foreign exchange swaps could have negative effects on the cost of dollar funding, by altering the covered interest parity. Specifically, they demonstrate that European banks lending in the US domestic market cut their dollar loans, more than their euro loans, in the presence of an adverse credit shock.

On the other hand, Shin (2012) provides evidence that European banking institutions had an important impact on the credit conditions in the United States market, via shadow banks. Global European banks, despite having a limited presence in the US deposit market, were able to mask their gross dollar positions by issuing asset-backed commercial paper in the US. According to the author, European banks functioned as channels through which financial conditions were transmitted around the globe. Further, Shin (2012) looks at European banks' use of the Term Auction Facility, established by the Federal Reserve, referring that European banking firms exposed to dollar-denominated ABCP were subjected to higher liquidity shortages than US banks, since the early stages of the financial crisis.

Acharya et al. (2007) study the liquidity shock by restricting their analysis to the period before the implementation of the TAF program. They examine the differences in access to dollar funding between foreign and US banks, showing that foreign banks with ABCP exposure increased their spreads for syndicated loans denominated in US dollars. Cetorelli and Goldberg (2012) also address the channels of financial contagion during the recent crisis. The authors look at the role of global banks in the transmission of funding shocks, focusing on parent banking companies, reallocating liquidity within the

² Bank for International Settlements.

organization. In the past decades, banks have increasingly established branches and subsidiaries in foreign countries, which allowed for the propagation of liquidity shocks at an international scale. Cetorelli and Goldberg (2012) focus on two different events for testing funding dynamics within banking institutions, the first being the US dollar shortage in the last quarters of 2007 and the second, and positive shock, of the implementation of the Term Auction Facility.

Closer to our work, Kamin and DeMarco (2012) study whether countries that held the largest amounts of US mortgage-backed securities and that were the highest dependent on US dollar funding were the ones experiencing the greater distress during the financial crisis. Also basing on country-level data, Gourinchas et al. (2012), determine if losses on countries' debt portfolios are related to their conduit exposure or the McGuire and Von Peter (2009) measure of US dollar shortage.

We add to the existent literature by using individual bank data in examining whether European banks that were guaranteeing ABCP conduits' investment in the US were the most affected by the financial crisis, since the beginning of the turmoil. Our specification approach follows the data treatment and basic methodology in Acharya et al. (2013), where the authors evaluate if banking institutions sponsoring conduit activity, in the United States and Europe, were the ones experiencing the lowest conduit returns at the start of the financial crisis. We distinguish from Acharya et al. (2013) by studying the impact of currency mismatches on the cumulative returns of European banks sponsoring ABCP investments in the United States, determining whether those banking institutions were the most harmed by the liquidity crisis.

Also, and based on the early studies of Cecchetti (2008, 2009) and Bernanke (2008, 2009b) we describe the main conventional and unconventional policy measures implemented by the Federal Reserve, in order to provide liquidity to financial institutions in distress. We specifically focus on the Term Auction Facility Program, one of the most utilized facilities by European banking companies, since it was first established on December 12, 2007, by the Fed's officials.

While most literature related to the use of the TAF is concentrated on the effectiveness of the program in lowering the spreads in the interbank market, little is known about the

banks participating in the Fed's auctions. In fact, researchers have not yet reached a consensus on the success of the Term Auction Facility. Taylor and Williams (2008) show that the program was not able to reduce the spread between Libor and the Federal funds rate and Thornton (2010) argues that at the time of its announcement, the TAF was responsible for increasing the risk premium in financial markets. Conversely, Wu (2008, 2011) finds empirical evidence that the government facility had an important effect in reducing the financial strains in the interbank money market.

Our work is related to Benmelech (2012) and Broz (2012), both demonstrating that European banks were the largest beneficiaries of the Term Auction Facility, since its implementation. Benmelech (2012), in particular, carefully examines the structure of the loans granted under the TAF program, showing that lending to US banks only exceeded borrowing by foreign banking institutions in the period immediately following the bankruptcy of Lehman Brothers. We follow the view presented in Shin (2012), arguing that the banks' use of the Term Auction Facility was an indicator of banking liquidity shortages after the ABCP shock. Specifically, we analyze whether European banks sponsoring conduit vehicles in the United States were the largest beneficiaries of the Term Auction Facility since 12th December, 2007.

3. The 2007-2008 Global Financial Crisis

In the period preceding the 2007-2008 global financial crisis, the low interest rate environment granted ease of access to credit, allowing mortgage lenders to borrow at extremely favorable terms, causing the escalation of real estate prices. In fact, home owners in the American housing market were able to easily secure credit and refinance their existing mortgages at better rates, by simply relying on the continuing upper movement in market values. Prior to 2007, the sector was critical in guaranteeing economic success, helping in the recovery that followed the Internet bubble burst in year 2000. However, and precisely because regulators feared a deflationary period after the DotCom crash, they continued to promote a policy of generous credit flows and low interest rates that eventually lead to the buildup of the housing bubble (Bezemer, 2011).

At the same time, “the banking system underwent an important transformation”, with traditional banking activities of granting and holding loans being increasingly replaced by securitization agreements (Brunnermeier, 2008). Large investment and commercial banks gradually became actual intermediaries between investors and borrowers by packaging and reselling loans in the capital markets. Under the banking “originate to distribute model”, mortgages, corporate bonds and other forms of credit were pooled together and sold to special purpose vehicles (SPVs), which functioned as off-balance sheet entities, providing for credit risk transfer. Securitization was essentially a risk sharing process intended to divide and distribute risky positions for a large number of investors (Acharya and Richardson, 2009). The mechanism itself involved combining different classes of loans into one large portfolio of assets that would then be transformed and resold to third-party investors in the form of securities. SPVs were thus responsible for slicing portfolios into different tranches according to their seniority and offered interest rates. As in standard capital structures, first losses on the pool would be allocated to the most junior tranches, followed by mezzanine, and super senior tranches, AAA rated. The asset backed securities (ABS), issued by SPVs, represented these same exact slices and were backed by the portfolios of loans held by the special purpose entities (Gorton and Metrick, 2012). Nevertheless, one should note that the newly issued

AAA-rated securities were not necessarily backed by very high quality credit. In reality, super senior tranches might be set up with recourse to a portfolio of nonprime loans, but defined as safer investments, with a first lien on the assets of the pool (Acharya and Richardson, 2009). Hence, the securitization mechanism made it possible to certain institutional investors to purchase assets they were previously prevented from holding, according to the established legal capital requirements (Brunnermeier, 2008).

SPVs, although they did not involve public issuance of equity, were actually very similar to real banks, as they were built with the purpose of collecting principal and interest payments on the underlying assets, handing them out to ABS investors. They allowed for risk sharing by performing maturity, credit and liquidity transformation and were part of the intermediation system, shadow banking. Shadow banks included all non-bank financial intermediaries that are not subjected to strict regulation, but carry out activities that were generally associated with traditional banking (Acharya et al., 2013). In the run up to the crisis, shadow banks were the key financiers of securitized assets, funding their asset purchases in the short-term asset-backed commercial paper markets or through other sources of financing outside the regulated banking sector. Similarly to traditional banks, which financed their operations with short-term deposits, the financial intermediation system was exposed to large maturity mismatches, purchasing medium to long-term assets by issuing short-term debt (Brunnermeier, 2008).

SPVs, whether they took the form of corporations, trusts, partnerships or limited liability companies, were characterized as bankruptcy remote vehicles, being independent from claims on the sponsoring bank, should it became insolvent. However, sponsorship was not exclusive for commercial and investment banks, with finance companies, hedge funds or insurance firms also placing assets off-balance sheet via special purpose entities. SPV structures were thus employed across the financial sector, in “programs for commercial mortgage-backed securities (CMBS), collateralized debt obligations (CDOs), collateralized loan obligations (CLOs), asset-backed commercial paper (ABCP) programs, and structured investment vehicles (SIVs)” (BIS, 2009). In addition to having their investment backed by an asset pool, buyers of these types of

securities could protect themselves against the risk of default of a particular bond or tranche by purchasing credit default swaps (CDS).

The rising popularity of securitized products was particularly important for the subprime sector, with approximately 80 percent of property mortgages to be financed via securitization (Gorton and Metrick, 2012). Housing was a mainstay of the US economy and an actual robust business investment for financial institutions, unable, at that moment, to profit from the established level of interest rates. Accounting for more than one fifth of the American GDP, spread over residential construction, household furniture, rental payments and other equivalent expenditures, the nation's real estate stock ascended to 17,8 trillion dollars (Schwartz, 2014), turning into a major attraction for securitized products. By increasing the distance between originators and borrowers, securitization mechanisms ultimately lead to poor-quality lending and may have accelerated the trend towards extending credit to riskier homeowners (Keys et al., 2008), actively fuelling the real estate bubble.

After 2001, the number of clients investing in the housing sector, mostly through the companies Fannie Mae and Freddie Mac, was progressively higher. The two government-sponsored enterprises (GSEs) were created as a part and post-Franklin Roosevelt's New Deal, in an attempt of injecting liquidity in the mortgage market: loans were bundled, tranced and then resold via securitization, offering the opportunity of constructing triple-A-rated securities through the pooling of below-investment-grade assets. As GSEs, the firms had their investments guaranteed by the US federal government, so, when banks started to grant credit to families with limited resources, requiring no downpayments or proof of income, Fannie Mae and Freddie Mac continued issuing the newly created securities. Subprime mortgages were a leading financial innovation between 2001 and 2006, functioning as short-maturity instruments, under a 'balloon interest payment'. Families that otherwise did not qualify for a home loan, started benefiting from a two-step contract that could be refinanced at the due date, avoiding the jump in the mortgage rate after two or three years of affordable refund (Gorton, 2008). The mechanism worked quite well as long as house prices continued to appreciate, with lenders either allowing for loan restructuring or keeping the property as consideration.

However, pre-crisis household market values and price annual increases of 10 percent came to a downturn in late 2006. Contrarily to the prevailing expectations and despite of the soft loan terms, virtually all subprime homeowners were unable to meet their mortgage payments, causing the system to collapse. Coupled with the steady increase on interest rates from 2004 onwards, the event of a widespread series of defaults in the subprime sector confirmed the undeniable flaw in the newly applied securitized system. Reductions in home construction and diminished demand for building supplies caused mortgage backed securities' values to decline, with lenders on the subprime sector asking for higher collateral, given the decrease in housing prices.

The period that followed announced the immediate bankruptcy of Ownit Mortgage Solutions and New Century Financial, a clear indication that “the subprime game had ended” (Schwartz, 2014). Losses promptly extended to investment banks, pension and hedge funds that had placed large sums in real estate related products, actively seeking for yield enhancement and higher profits. Mounting delinquencies in the sector shook investors' confidence in the financial intermediaries that were issuing liabilities against subprime loans. Consequently, investors became increasingly reluctant in rolling over short-term debt and particularly ABCP, the most traditional form of short-term credit and a central funding channel for structured investment vehicles and conduits, in the years preceding the financial crisis (Shleifer, 2010). What happened was analogous to traditional bank runs in the past century, where customers tried en masse to withdraw their saving deposits (Gorton and Metrick, 2012). In 2007-2009, the severe stoppages in short term refinancing, with soaring yields for new issuances, lead to an unprecedented shadow bank run that caused financial markets to collapse.

On July 31, 2007, two Bear Stearns' hedge funds, that had invested huge amounts in securitized subprime mortgages and collateralized debt obligations, filed for bankruptcy. One week later, on August 9, 2007, BNP Paribas halted withdrawals from three of its investment funds, on the account of a complete evaporation of liquidity. Values for ABCP outstanding, the largest money market instrument for the US market, decreased \$190 billion in August 2007 and by an additional \$160 billion until December that year (Covitz et al., 2009). Within one day of BNP Paribas announcement, the interest rate spread of overnight ABCP over the federal funds rate jumped from 10 to

150 basis points (Acharya et al., 2013). In the period that followed, the Federal Reserve tried to inject liquidity in the asset-backed commercial paper market, via overnight repurchase agreements and discount-window loans. On December 12, 2007, the Fed created the Term Auction Facility (TAF) program, extending borrowing conditions for a term of 28 to 35 days. Over the next months, the Fed's target interest rate was lowered by 325 basis points and the TAF funding program was extended, including a new series of term repurchase transactions worth \$100 billion (Kacperczyk and Schnabl, 2009).

However, and even though the regulatory actions were apparently successful in stabilizing the financial system after the first shock in the ABCP market, a number of money market funds suffered substantial losses on September, 2008, following the Lehman Brothers' bankruptcy (Brunnermeier, 2008). Lehman was the fourth largest investment bank in the United States and a global financial services firm that had placed large sums in the subprime and other securitized sectors. The effects of Lehman's bankruptcy, in September 15, promptly affected the financial and interbank markets (Gorton and Metrick, 2012), causing severe disruptions in the investment bank's counterparties. When the Reserve Primary Fund, one of the largest money market funds in the US, announced to third-party investors that it had suffered losses on its \$785 million of Lehman's commercial paper, the situation in the interbank market worsened again. After the Reserve Primary Fund's announcement on 16 September, withdrawal requests extended to large money market funds with commercial paper holdings (Kacperczyk and Schnabl, 2009).

4. The Asset-backed Commercial Paper Market

4.1 Asset-backed Commercial Paper

Historically, commercial paper was a form of unsecured and highly liquid short-term debt reserved to large, credit worthiness corporations, with sound balance sheets and important flows of funds (Calomiris et. al., 1995). Maturities normally range up to 270 days, although typical issuances are set at an average of 60 days. As one of the cheapest sources of external financing for companies, commercial paper provides for an alternative mechanism to classical bank lending, representing about one-sixth of total US bank loans in 2002 (Shen, 2002).

During the 1980s, the market for commercial paper promissory notes grew up to five times its size, following the heavy activity in mergers and acquisitions and the developments in the swaps market and money market fund industry. Commercial paper issuances were extended to smaller US corporations, foreign firms and foreign financial institutions, while traditional borrowers strengthened their investment positions. Also, ABCP emerged as a new form of asset securitization. Banks, as they became increasingly familiarized with structured products, saw an opportunity to expand their financing alternatives and those of their clients, guaranteeing a fee income through potential participants in their programs. They started transferring their assets to a special purpose vehicle, or ABCP conduit, easing regulatory pressures over minimum capital requirements, whereas maintaining customer relationships by continuing to service the receivables (Post et al., 1992).

After 2004, changes in the US banking regulation came to exclude assets in off-balance sheet vehicles from risk-weighted calculations. In Europe, following the adoption of the International Financial Reporting Standards (IFRS), asset transfers to SPVs should not be recognized as a true sale; however, the majority of regulators did not change capital requirements in conformity with the directive. By placing assets in off-balance sheet conduits, banks benefited from regulatory arbitrage and were thus able to undertake

significant high risks without holding capital against its investments (Acharya et al., 2013).

ABCP conduits are special purpose vehicles established by sponsoring financial institutions (administrators) with the objective of funding a portfolio of assets through the issuance of asset-backed commercial paper. They bring together borrowers and lenders, facilitating the flow of funds between corporations and third-party investors, and function as stand-alone and bankruptcy remote entities. In fact, and although the sponsors often provide administrative services, credit and liquidity enhancement to the ABCP conduit, they do not own the SPV (Bens and Monahan, 2008). With no statements consolidated under the sponsoring firm, conduits are designed to acquire large pools of receivables from one or several asset originators, using the proceeds from commercial paper issuance to finance their purchases.

ABCP sold to institutional investors is thus commercial paper guaranteed by the asset pool owned by the conduit and is simultaneously the central source of funding for the off-balance sheet vehicle. Assets financed with ABCP generally have a 3 to 5-year maturity and include trade receivables, collateralized debt obligations, asset-backed and mortgage-backed securities, auto and equipment loans and leases, corporate and government bonds and commercial paper issued by other entities (Fitch Ratings, 2001). Because conduits essentially finance these assets with asset-backed commercial paper limited to a tenor of 30 days, they are dependent on their ability of rolling-over ABCP to pay-off maturing liabilities. As in what happens with traditional banks, conduits exhibit a significant maturity mismatch, as they primarily utilize short-term debt notes to purchase long-term assets from the originating companies (Acharya and Richardson, 2009).

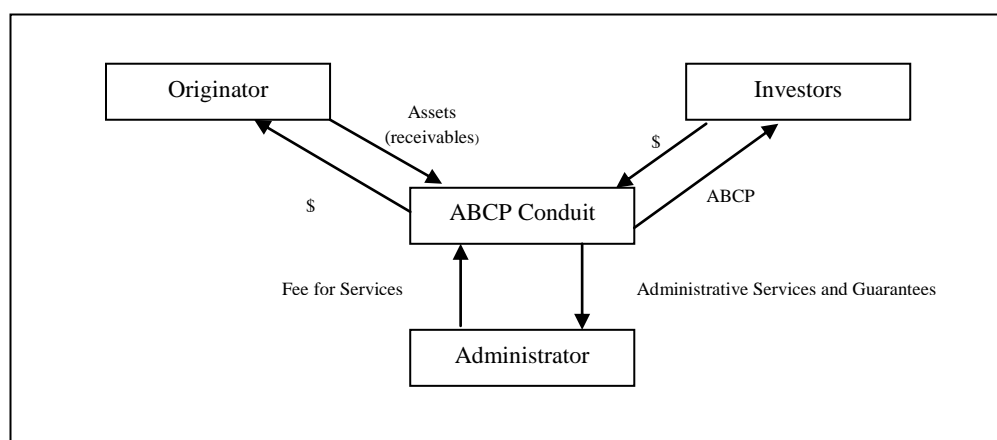
In addition to new ABCP sales, funding sources for conduits can also include the collection of receivables on the financial assets held by the SPV, or the use of guarantees provided by the sponsoring firm. Sponsors are typically very large commercial banks, based in the United States and Europe, that grant administrative services and explicit guarantees to the conduit, in exchange for a contracted fee. Conduits with full credit support are 100 percent backed with credit guarantees and will

require the sponsor to pay off maturing ABCP in the event of a default. Because they are practically equivalent to on-balance sheet financing, exposing sponsoring firms to very high risks, they are usually not utilized by banks in need to reduce their capital requirements. Liquidity guarantees are the most used by commercial banks and, although they do not cover conduit assets' defaults, they are structured to pay off maturing ABCP and, therefore, to prevent those situations. Extendible notes and SIV guarantees – arranged via structure investment vehicles – are the two weakest forms of protection, respectively allowing conduits to extend maturing commercial paper and uninsured debt for a defined period of time (Acharya et al., 2013).

During the 2007 run, the combined set of guarantees restrained losses for outside investors in the ABCP market, with sponsoring institutions concentrating the full risks of commercial paper issuances on their balance sheets. Specifically for liquidity and credit enhancement, sponsors were forced to purchase the underlying assets held in conduits, directly delivering cash to the SPV. In fact, as long as the sponsoring institution was kept solvent, ABCP represented a risk-free instrument for outside investors in the financial markets, as it was jointly backed by conduit assets and insurance guarantees provided by the sponsor (Acharya and Schnabl, 2010).

Figure 1 illustrates the basic structure of an asset-backed commercial paper conduit.

Figure 1. ABCP conduit structure

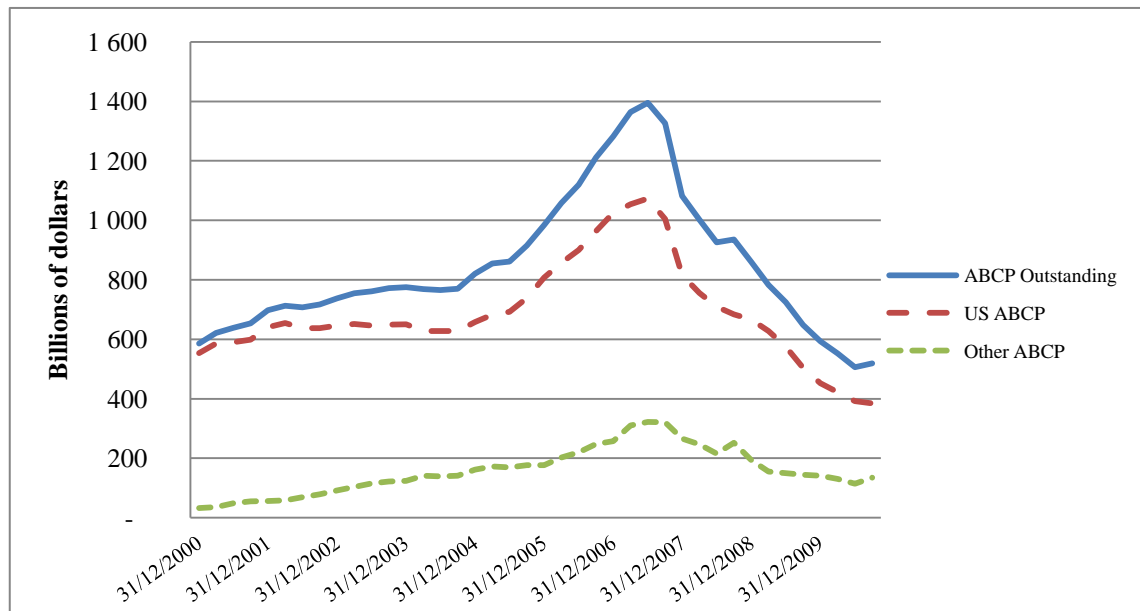


ABCP conduits are set by sponsors, or administrators, that offer management services and insurance guarantees to the special purpose vehicles, assuming most of its economic risks and rewards. Conduits, as stand-alone, bankruptcy remote entities, purchase large pools of receivables from one or several asset originators and fund acquisitions by selling unsecured promissory debt notes to third-party investors. Separate roles for sponsors and asset originators typically indicate situations where conduits are established for benefiting the sponsors' clients, providing them with alternative funding mechanisms. Because conduits purchase assets from different sellers, the structure is referred to as a multi-seller conduit program. ABCP program structures can also be classified as single-seller, if the sponsor is the asset originator and intends to establish a new source of financing for its business activity, or as securities-backed, when the sponsor invests in asset-backed, mortgage-backed or corporate securities for regulatory arbitrage purposes. This is normally the case for banking institutions subjected to strict capital requirements, which intend to lower their capital ratios by placing assets in off-balance sheet vehicles. Finally, hybrid structures may incorporate elements of both multi-seller and securities-backed formats, covering the funding needs of ABCP administrators and those of its clients (Moody's Investors Service, 2003).

Asset-backed commercial paper was largely important in the years preceding the global financial crisis and had played a fundamental role on the debt run that started in the summer of 2007. As a central funding mechanism for structured investment vehicles (Shleifer, 2010) and private-label assets in the US, it was the largest short-term debt instrument in the shadow banking system, significantly exceeding the size of repo transactions and other sources of financing for securitization activities (Krishnamurthy et al., 2014). Institutional investors ran on ABCP starting August 9, following the announcement of BNP Paribas which suspended withdrawals on three of its investment funds. The severe stoppages in ABCP refinancing brought very negative effects on conduits, in need to roll-over their short-term liabilities, and on sponsoring institutions, that were offering explicit guarantees to the off-balance sheet vehicles (Covitz et al., 2009). Runs for other short-term debt instruments initiated after the turmoil in the ABCP market had already unfolded, respectively on September 2007, for sale and repurchase agreements, and on September 2008, for money market funds (Schroth et al., 2014).

Figure 2. ABCP outstandings as of January 1, 2007

Conduit data is from Moody's Investors Service Quarterly Spreadsheets and is stated in thousands of dollars. US ABCP is ABCP issued in the US market and Other ABCP is ABCP issued in Europe, Australia, Canada, Japan and South Africa.



As shown in figure 2, values for US and global ABCP outstanding fell by nearly 40 percent, from June 2007 until December 2008, reflecting investors' growing lack of confidence in the market and their increasing reluctance in rolling over maturing commercial paper. After a period of long exponential growth, marked by important changes in banking regulation, global ABCP peaked at 1395 billion dollars in mid-2007. Commercial banks, sponsoring roughly 75 percent of conduit vehicles (Kacperczyk and Schnabl, 2009), had then significant advantages in placing assets in off-balance sheet entities, reducing or maintaining their capital ratios for higher risks. In the United States, the largest market for ABCP issuance, total outstanding reached 1073 billion dollars in 2007 and contracted by over 230 billion from June to December that year. Other ABCP refers to asset-backed commercial paper issued in Europe, Australia, Canada, Japan and South Africa and represents a relatively small part of total investment in ABCP, when compared with total outstanding for the global market.

4.2 The Investment in the US ABCP Market and the US dollar shortage

During recent decades, and until the onset of the financial crisis in 2007, global banks were expanding their international activities, increasing cross-border lending and their “appetite for foreign assets”. Banking had become progressively more globalized, bolstered by the growth on structured products, hedge fund industry and the spread of universal banking, with total foreign claims reaching 31 trillion dollars in 2007. After year 2000, the growth on cross-border positions was particularly high for European banks, primarily investing in dollars, in the United States (McGuire and Von Peter, 2009). At the time, US interest rates were higher than those of the European countries and banks in Europe exhibited a significant home-bias in their equity investments. Also, the inadequacy of regulatory capital requirements and the growth of asset-backed securitization favored the investment in structured products, essentially in the mortgage real estate market (Bernanke et al., 2011).

In the early stages of the financial crisis, US dollar-denominated holdings for European global banks were comparable, in size, to the total assets in the US commercial banking sector (Shin, 2012) and represented, for some European banking systems, more than half of the increase in the overall foreign investment since end-2000 (McGuire and Von Peter, 2009). In a period that followed the introduction of the common-currency, facilitating the intra-euro area trading, the growth in US dollar-denominated claims was, in fact, quite remarkable. Global banks, however, hedged their currency exposure by issuing debt in US dollars, and masked their gross positions by netting out total assets and liabilities (Shin, 2012). Funding was mainly provided via very short-term debt instruments, with securitized asset-backed commercial paper programs accounting for the largest share on total debt issuances. Until year 2007, commercial paper was the most important source of short-term financing in the US market and ABCP was the primary type of funding for short-term institutional borrowers (Cetorelli and Goldberg, 2012).

Table 1 shows ABCP holdings by country, for all commercial bank sponsors, as of January 1, 2007.

Table 1. ABCP holdings by country of origin as of January 1, 2007

Conduit data is from Moody's Investors Service Quarterly Spreadsheets, US ABCP is ABCP issued in the US market and Other ABCP is ABCP issued in Europe, Australia, Canada, Japan and South Africa. The sample is restricted to commercial bank sponsors. Values are stated in thousands of dollars.

Country	US ABCP	Other ABCP	ABCP Outstanding
Belgium	21 391 570	13 809 500	35 201 070
Denmark	1 795 900	-	1 795 900
France	50 201 110	30 346 920	80 548 030
Germany	52 064 790	24 895 190	76 959 980
Italy	19 176 580	4 450 130	23 626 710
Netherlands	63 615 220	31 376 490	94 991 710
Spain	2 126 820	4 210 850	6 337 670
Sweden	1 718 760	352 900	2 071 660
Switzerland	4 475 320	-	4 475 320
United Kingdom	118 675 460	13 093 640	131 769 100
Europe	335 241 530	122 535 620	457 777 150
United States	216 440 000	229 533 640	445 973 640
Other	52 402 960	29 150 000	81 552 960
Total	604 084 490	381 219 260	985 303 750

ABCP issued in dollars, in the United States market, represented over 60 percent of total commercial paper outstanding, although the majority of ABCP exposure was concentrated amongst foreign commercial banks, mainly located in Europe. European commercial banks were the largest administrators of conduit vehicles in the ABCP market, sponsoring nearly 458 billion dollars in early 2007. United Kingdom, Netherlands France and Germany were the four top European countries in terms of ABCP exposure, mainly investing in the US dollar market via ABCP conduits. Globally, European commercial banks sponsored 335 billion dollars in the US market, compared with the \$216 billion outstanding for US domestic banks.

When in the summer of 2007 the turmoil in the ABCP market unfolded, reflecting investors' concerns regarding the "overall quality of the assets backing commercial paper issuances", (Cetorelli and Goldberg, 2012), banking institutions with higher conduit exposure were suffering the most negative effects from the first run on ABCP (Acharya et al., 2013). However, European banks that were guaranteeing conduits' investment in US dollars were subjected to severe liquidity shortages, higher than those encountered by US sponsoring banks in the sector (Shin, 2012). In fact, conduits established by European bank sponsors, although they hedged their US long positions by issuing short-term dollar liabilities, were facing additional exposure to US asset-backed securities (Kamin and De Marco, 2012).

Given their reliance on short-term dollar funding, foreign bank sponsors were vulnerable to important currency mismatches, as they had to provide liquidity in non-domestic currency, if their funding positions could not be rolled-over (Broz, 2012). At the start of the financial crisis, when banks were forced to secure alternative funding sources to offset losses on conduit activity, European and other foreign bank sponsors investing in the United States substantially increased their demand for US dollar funding (Acharya and Schnabl, 2010).

Differently from banks headquartered in the United States, which had direct access to US domestic deposits and to the Federal Home Bank Loans system (Acharya et al., 2013), foreign banks had to try to raise liquidity in the dollar-denominated wholesales market or by accessing local deposits and exchanging them into US dollars. However, after the onset of the financial crisis in August, 2007, the tightening credit conditions led to “severe disruptions in the interbank and foreign exchange swaps markets” (McGuire and Von Peter, 2009) causing foreign and particularly European banks to not increase dollar funding by as much as they needed (Bernanke, 2010).

European banks sponsoring conduits in the US market, as they were the most exposed to dollar liquidity shortages from the beginning of the ABCP freeze, played a very important role in the rapid unfolding of the global financial crisis (Shin, 2012). The decision to establish conduit vehicles that incorporated recourse to banking institutions’ balance sheets was contrary to the risk-spreading objective of conventional securitization mechanisms and, combined with asymmetries in terms of funding for domestic and foreign banks, significantly increased risk-taking for European banks sponsoring conduit vehicles in the US ABCP market. After December 12, 2007, they were able to borrow from the Term Auction Facility and Central Bank Liquidity Swap Lines established by the Federal Reserve (Acharya et al., 2013).

Foreign banks with branches in the United States could also make use of the Federal Reserve’s Discount Window program, as it provided financing to all solvent banking institutions with pledgeable US assets. However, because of the stigma associated with the Discount Window use, very few banks accessed the government facility (Armantier et al., 2010).

5. The Federal Reserve as a global lender of last resort

When on December 1, 2010, following the early implementation of the Dodd-Frank Wall Street Reform and Consumer Protection Act, the Federal Reserve was forced to release detailed information on the programs used to respond to the recent financial crisis, the disclosures revealed the extension of the Fed's aid to foreign banks, outside the US.

The Federal Reserve, in its function of guaranteeing economic stability across domestic financial markets, should supervise the operations of US and foreign banks with branches in the country and serve as lender of last resort, should the supply of liquidity be inadequate to meet the credit needs for the banking system (Broz, 2012). The lender of last resort function, with commercial banks borrowing directly from the Fed at a primary (discount) lending rate or using the liquidity facilities made available by governmental officials, is a key regulatory mechanism for the country's central bank, when the interbank market can no longer provide liquidity to solvent banks in need for credit (Armantier et al., 2010).

During the 2007-2009 global financial crisis, what happened was that foreign, and particularly European banks, were amongst the largest beneficiaries of the special emergency programs established by the Fed during and after the summer of 2007 (Broz, 2012). European banks, as a result of the increasing globalization in financial markets, had heavily invested in dollar-denominated assets, funding their purchases via US short-term debt, especially in the asset-backed commercial paper market (Cetorelli and Goldberg, 2012).

In the aftermath of the ABCP shock, foreign banks, other than suffering losses related to conduit's activity maturity mismatches, were also at risk that their dollar-denominated funding positions could not be rolled over. Whereas for US-located banks there were available secure governmental long-term financing sources, European banks were facing higher liquidity pressures, as they had to rely on very short-term or demandable types of funding. In response to such liquidity shortfalls, and actively trying to protect

the US domestic markets, the Federal Reserve made available a set of emergency lending facilities in order to reduce dollar funding pressures for both the US and foreign banking institutions. Dollar funding shortages for foreign banks investing in the United States did not only affected banks' balance sheets and solvency ratios, but might also have adverse effects in the US real economy, especially for US firms directly borrowing from foreign banks (Acharya et al., 2013).

In the early stages of the global financial crisis, prior to the US implementation of liquidity and credit facilities, central banks around the world began to make use of the classic monetary policy tools, influencing money supply by altering lending rates in the financial system (Wu, 2008).

For the United States Federal government, the seven cuts in the target Fed funds rate, totaling 325 basis points, from September, 2007, to May, 2008, accompanied the reductions in the cost of the Discount Window borrowing. Starting on August 17, 2007, the term of discount loans increased from overnight to 30 and then to 90 days and the primary (discount) lending rate – at which the Fed lends to eligible depository institutions – was cut from 100 to 50 and finally 25 basis points above the federal funds rate (Cecchetti, 2009).

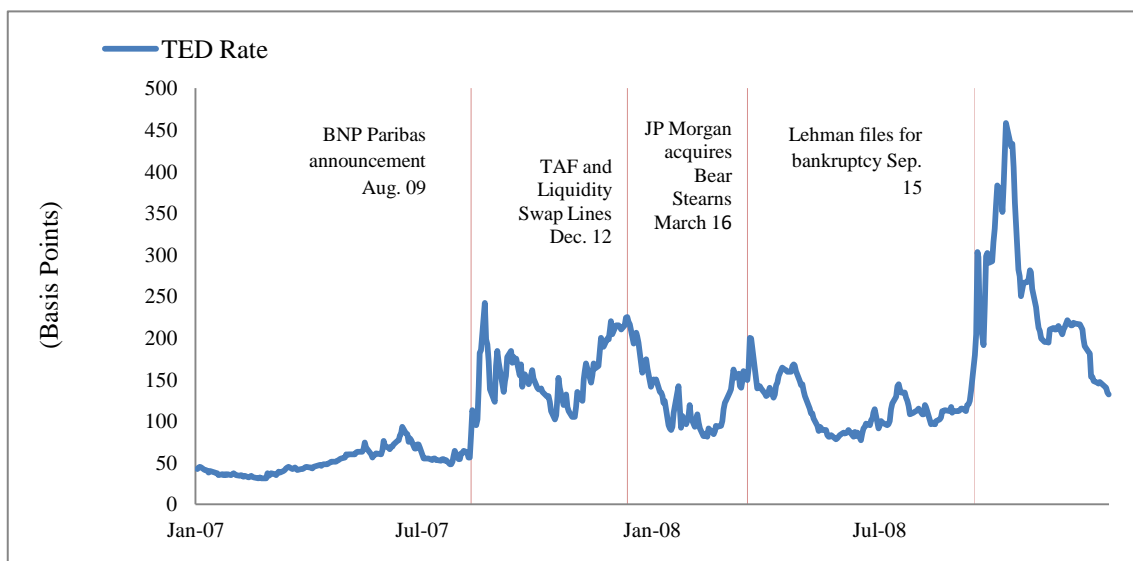
The Discount Window facility is a last-resort funding mechanism for depository institutions with pledgeable US assets, that do not have any other means of access to credit. During market disruptions, when interbank lending becomes insufficient to meet private liquidity needs, banks can resort to Discount Window loans, as long as they can satisfy the Fed that they do not have any other funding alternatives available. Therefore, if market participants became aware that certain depository institutions had access to the Fed's facility, they could interpret the recourse to funding as an indicator of financial weakness (Armantier et al., 2010). Banks, in the presence of this Discount Window stigma, and despite of the Federal Reserve's measures to enhance liquidity, were highly reluctant to increase their borrowings from the Fed, during the financial crisis period (Bernanke, 2009a).

By year-end 2007, when it became clear that the use of traditional monetary and Discount Window tools was being insufficient in improving the overall economic

conditions, the Federal Reserve introduced a number of less conventional actions in order to address financial distress (Bernanke, 2009b).

As shown in figure 3, values for the spread between 3-month Libor and 3-month expected federal funds rate (TED spread), an indicator of the perceived credit risk in the overall economy³, remained relatively high until December 2007.

Figure 3. Evolution of the TED rate as of January 2007
Data is from the Federal Reserve Bank of St. Louis.



The establishment of the Term Auction Facility (TAF), on December 12, by ensuring perfect anonymity to all borrowing participants in the program, provided a satisfactory alternative to discount window lending (Cecchetti, 2009). Through the TAF procedures, between December 17, 2007, and March, 8, 2010, the Fed conducted a total of 60 auctions roughly every two weeks, allowing depository institutions in sound financial condition to raise funding for terms of 28 and 84 days, with a few exceptions. Initially, the amount of credit available was set at \$20 billion, but at the height of the financial

³ The TED spread, by representing the difference between the interest rate on interbank lending and the interest rate on the short-term US government debt, can be used as a measure of the perceived credit risk in the economy.

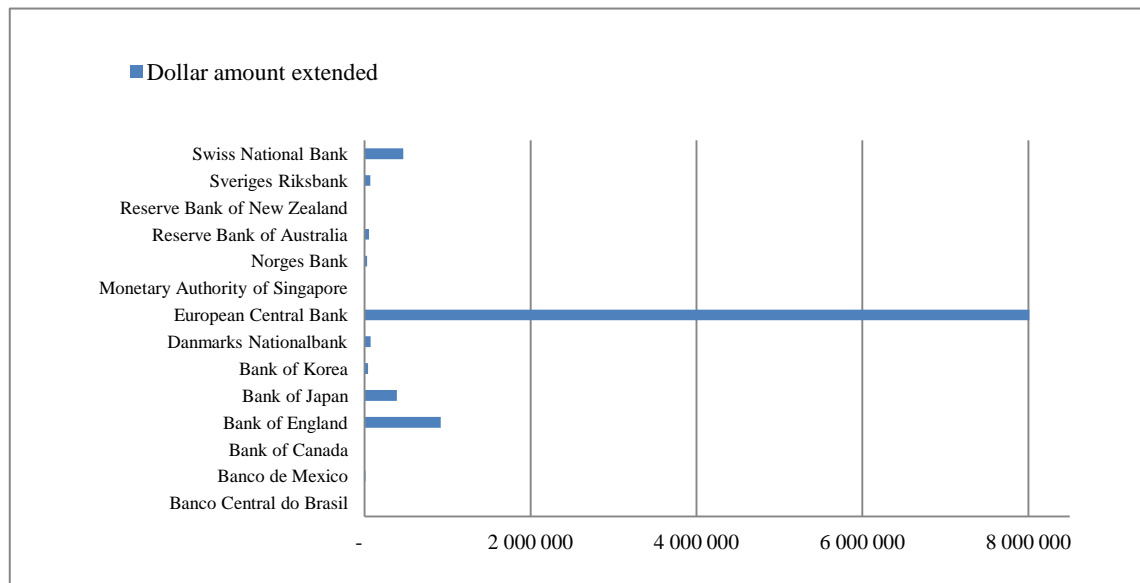
crisis, total funding extended up until 150 billion dollars per auction (Armantier et al., 2010). Differently from discount window borrowing, where the lending cost is previously fixed by the Fed, the TAF interest rate was set through a competitive auction mechanism, in which the minimum bid was determined via expected federal funds rate over the auction term. Beginning with the highest offered interest rate, funds were allocated at a maximum of 10 percent for each borrowing participant and were credited to the winning bidders 2 days after the date of the auction. Importantly, all loans were fully collateralized “by at least a factor of two”, although the Fed admitted as eligible collateral a wide range of assets with little market value. As what happened for all other lending facilities established by the Federal Reserve, TAF loans did not increase risk for the Fed, nor did they augmented the size of its balance sheet, as they implied a decrease in outright securities holdings, in equal proportion (Cecchetti, 2009).

At the same time, and in the view of further extending the international reach of the Term Auction Facility program, the US Federal Reserve set up bilateral currency swap agreements with other country’s central banks (Bordo et al., 2012). Collectively, until February 1, 2010, the Fed transferred over half a trillion dollars to fourteen foreign central banks with significant dollar-denominated exposure. Transactions functioned as general liquidity swaps, in which central banks, by paying a determined fee, were able to acquire a given amount of dollars from the Fed, exchanging it for the equivalent value in their currency. Central Banks were then responsible for lending the total dollar amount to banking institutions in their jurisdictions, assuming the full credit risk on loan repayment. The transaction would be closed at maturity, when central banks returned the dollar amount and received the value in their domestic currency, considering the previous established exchange rate (Broz, 2012).

Dollar swap agreements were particularly important for the European Central Bank, the Bank of England and the Swiss National Bank, which took over about 80, 9 and 5 percent, respectively, of the total amount drawn through the program. In fact, arrangements established under the Liquidity Swap Lines facility were set up with central banks in countries of especial relevance to the US economy, generally regular trading partners or global financial centres (Broz, 2012). Figure 4 illustrates the large differences between dollar amounts extended to foreign central banks, between

December 17, 2007 and July 13, 2010, under the bilateral currency swap agreements set up by the Federal Reserve.

Figure 4. Dollar amount extended to foreign Central Banks under the Bilateral Currency Swap agreements
Data on the Bilateral Currency Swap agreements is for the period between December 17, 2007, and July 13, 2010 and is taken from the Federal Reserve Board of Governors.
Values are stated in millions of dollars.



From early December, 2007, until the end of February, the following year, values for the TED spread (on figure 3) reduced by over 100 basis points, suggesting that the Federal Reserve’s facilities were effective in stabilizing the interbank market. However, stress increased again in March, 2008, at the time of the new run on Bear Stearns investment bank. As liquidity in the market for repo transactions dried up and “US Treasury securities of all varieties became extremely scarce”, the Federal Reserve created, on March 11, that year, the Term Securities Lending Facility (TSLF) (Cecchetti, 2009). Through the TSFL, the Fed’s primary dealers, including non-depository institutions, were able to obtain US treasury securities by delivering highly-rated residential MBS and private-label ABS as collateral (Wu, 2008). Also on mid-March, 2008, at the peak of the Bear Stearns crisis, the Fed introduced the Primary Dealer Credit Facility (PDCF), enabling the Federal Reserve Bank of New York to

grant overnight loans on a collateralized basis to its primary dealers (Adrian et al., 2009).

Later, in September, 2008, following the bankruptcy of Leman Brothers and the subsequent run on money market funds, the Fed implemented the Asset-Backed Commercial Paper Money Mutual Fund Liquidity Facility (AMLF), with the objective of increasing liquidity in the ABCP market and in the money market mutual fund industry (Duygan-Bump et al., 2013). Furthermore, and after October 7, 2008, commercial paper issuers could make use of the Commercial Paper Funding Facility (CPFF), established by the Fed as a backstop liquidity instrument that allowed issuing firms to roll over their maturing liabilities (Adrian et al., 2009).

Finally, the Federal Reserve addressed the problems in securitization markets by creating the Term Asset-Backed Loan Facility (TALF) on 25th November, 2008. The program started operations in March, the next year, and was designed to support the issuance of asset backed securities' issuances, collateralized by consumer and small business loans (Campbell et al., 2011).

6. Empirical Analysis

6.1 Stock return performance of European bank sponsors backing conduits' investment in the US

6.1.1 Data and summary statistics

We use three different sources of data in order to analyze the effect of currency mismatches on banking stock returns, focusing on European banks that were guaranteeing ABCP conduits' investment in the US, in the early stages of the global financial crisis.

We collect quarterly data on all asset-backed commercial paper conduits, from 2001 until 2010, using ABCP Program Index spreadsheets from Moody's Investors Service, which summarize basic information on conduit programs. Data includes conduit name and administrator, authorized amount to be issued, average commercial paper outstandings per quarter (for the US and other markets) and information on asset type⁴, program type⁵, conduit support⁶ and rating assigned by Moody's.

Data specifications follow the work of Acharya et al. (2013). We construct our main dataset using Moody's quarterly data on all commercial banks located in the United States and Europe. For each quarter, we merge all conduit observations under the same sponsoring institution, distinguishing between total commercial paper issuances in the United States and in other markets, such as Europe, Australia, South Africa, Canada and Japan. When more than one entity is listed as the program administrator, we consider the first entity listed as the sponsoring firm, as it is indicated in Moody's ABCP Program Index.

⁴ Assets in which the ABCP conduit invests in: asset-backed securities, commercial mortgages, corporate loans, credit card receivables, credit default swaps.

⁵ ABCP program structure: multiseller, single-seller, securities-backed or hybrid structures.

⁶ Indicates whether the conduit is 100% backed by credit guarantees (fully supported) or partially supported.

We use Bankscope in order to identify whether the sponsor is a commercial bank or other type of banking institution defined in the database: investment bank, specialized governmental credit institution, real estate and mortgage bank, finance company, etc. If we cannot find a match on Bankscope, i.e. if the sponsoring firm is not a banking institution, we conduct an internet search. We find that, other than commercial banks, sponsors on ABCP programs are typically structured finance companies, mortgage originators or asset and investment managers. We use firms' annual reports and online available firm information to identify the parent company associated to each conduit sponsor. We aggregate commercial banks at the level of the consolidated holding financial company (e.g., Citigroup consolidates conduit data on Citibank NA, Citibank (South Dakota) NA and Citibank International Plc).

We use Bankscope to construct a new dataset on all commercial banks based in the United States and Europe, with more than 10 billion dollars in total assets. Introducing smaller banks in the sample would have significantly biased the results, precisely because they do not have the financial strength to sponsor conduit vehicles. We drop banks that do not have available information during the period and overcome double counting issues, by considering only consolidated financial statements on Bankscope⁷. Also, we identify the parent financial company for all commercial banks in the sample, at the beginning of 2007. If the consolidated parent company and its subsidiaries have more than one entry on Bankscope dataset, we keep only the parent company. We use the International Securities Identification Number (ISIN) provided on Bankscope, to match commercial bank data to equity returns on Datastream. We collect stock return index data for all banking institutions with available share price information in year 2007.

⁷ As explained in Duprey and LÉ (2014), the Bankscope database provides company financial statements for a large set of banking institutions, in both consolidated and unconsolidated forms. Hence, for a given bank, the available consolidated financial statement integrates balance sheet information on its affiliates or subsidiaries. In order to avoid double counting issues, it is necessary for the database user to choose between consolidated and unconsolidated financial statements, depending on his research question. Further double counting problems may appear in cases where both main and additional statements (as referred by the consolidation codes C* or U*) are available and the user should choose between using one of the two options. Also, and because Bankscope consolidation codes do not provide information on bank ownership structure, i.e. they do not distinguish between consolidated statements of a parent company and consolidated statements of a subsidiary bank, it is necessary to determine the evolution of parent/subsidiary relations at the time of the analysis.

Table 2. The twelve largest conduit sponsors as of January 1, 2007

Conduit data is from Moody's Investors Service Quarterly Spreadsheets, US ABCP is ABCP issued in the US market and Other ABCP is ABCP issued in Europe, Australia, Canada, Japan and South Africa. Asset-backed commercial paper is stated in thousands of dollars.

Administrator	Country	US ABCP	Other ABCP	ABCP Outstanding
Citigroup	United States	86 328 510	6 342 930	92 671 440
ABN AMRO Bank N.V.	Netherlands	51 887 200	16 686 910	68 574 110
The Liberty Hampshire Company, LLC	United States	48 239 000	0	48 239 000
Bank of America, N.A.	United States	45 548 890	141 670	45 690 560
HBOS Plc	United Kingdom	28 645 640	15 254 380	43 900 020
Societe Generale	France	31 201 520	12 293 510	43 495 030
JPMorgan Chase Bank	United States	36 103 900	6 609 040	42 712 940
HSBC Holdings Plc	United Kingdom	29 636 180	9 789 450	39 425 630
Deutsche Bank AG	Germany	23 341 860	15 394 200	38 736 060
BSN Holdings Limited	United Kingdom	29 888 000	6 684 040	36 572 040
Barclays PLC	United Kingdom	33 070 000	381 510	33 451 510
Rabobank	Netherlands	28 107 590	2 665 560	30 773 150

Table 2 shows the twelve largest conduit sponsors, as of January 1, 2007. Citigroup, the parent holding company for Citibank NA, Citibank (South Dakota) NA and Citibank International Plc, was the largest ABCP administrator in the market, sponsoring over 92.67 billion dollars in commercial paper. Of the twelve conduit sponsors on table 2, only two of them are non-banking institutions and one is not operating in the commercial banking sector – Rabobank. There are nine commercial banks administrating ABCP conduit vehicles, six of which are based in European countries.

Overall, conduit vehicles sponsored by European commercial banks invested primarily in US ABCP, for an aggregate value outstanding of 335.24 billion dollars. On average, they were amongst the foreign banking institutions with larger exposure to US conduit vehicles, measured by the 73 percent ratio between US ABCP and total ABCP outstanding. Particularly during the pre-crisis period, European global banks had substantially increased their US dollar holdings, funding their positions in the dollar-denominated short-term debt market. United Kingdom, Netherlands and Germany were the three top European countries in terms of total ABCP investment by commercial banks in the US market, together exceeding the 216.44 billion dollars of US ABCP outstanding for American domestic banks in the commercial banking sector.

6.1.2 Methodology

This subsection analyzes whether European commercial banks sponsoring conduits' investment in the United States had experienced the lowest stock returns in the early-stages of the global financial crisis. European bank sponsors were, as well as all other conduit administrators, greatly exposed to large maturity mismatches, but faced additional exposure to US asset-backed securities, by financing their ABCP vehicles in non-domestic currency. Arguably, in the beginning of the financial crisis, European banks investing in US commercial paper SPVs were subjected to the most severe liquidity shortages, as they had increased difficulties in rolling-over their dollar funding positions. Differently from banks in the United States, that were able to tap into alternative stable funding sources, European banking institutions had to raise liquidity in the dollar wholesales market or by accessing local European deposits and swap them into US dollars.

We used equity cumulative returns as an indicator of banking performance at the onset of the financial crisis. As defined in the Datastream database, equity returns – expressed through the total return index, RI – represent the theoretical aggregate growth in the value of a share over a specific period of time, assuming that dividends are reinvested to purchase additional units of equity at the closing price applicable on the ex-dividend date.

We follow the model specifications in Acharya et al. (2013), considering cumulative stock returns over the narrow 3-day window period from August 8 to August 10, 2007. Restricting the analysis to such a short window event has the objective of isolating the effects of US commercial paper sponsorship on the stock returns of European banks. As argued by the authors, during the financial crisis, there were other variables affecting banking performance, some of which correlated with conduit sponsorship. August 9, 2007, the day of BNP Paribas' announcement that suspended withdrawals on three of its investment funds, marked the start of the crisis in the ABCP market and, for that, it provides a good setting for identifying the impacts of currency mismatches on stock returns.

Our sample is restricted to the group of all commercial banks located in the United States and Europe, with more than 10 billion dollars in total assets and share price data available, as of January 1, 2007. We estimate the following linear regression model, controlling for differences in bank observable characteristics:

$$R_i = \beta_1 + \beta_2 D_i + \beta_3 X_i + \varepsilon_i$$

where R_i is the cumulative equity return of bank i during the period from August 8 to August 10, 2007, and D_i is a dummy variable equal to 1 if the bank i is an European banking institution sponsoring conduits' investment in the US market, and 0, otherwise. X_i are bank i 's observable characteristics, as of January 1, 2007– bank size, return on assets, share of assets funded with short-term debt and share of assets funded with deposits – and ε_i represents the bank specific error term.

Because stock returns on Datastream are expressed as an index, computing the cumulative returns implies, at first, to obtain the actual daily returns – the percentage calculation of the differences per day of the R_i . We calculate, for each day and banking institution:

$$\text{Daily return} = \frac{RI_{(t)} - RI_{(t-1)}}{RI_{(t-1)}}$$

The cumulative return is computed using the formula:

$$(1 + \text{daily return}_{08})(1 + \text{daily return}_{09})(1 + \text{daily return}_{10}) - 1$$

In addition to estimating the effect of currency mismatches on bank stock returns from August 8 to August 10, we focus on that same exact relation for the previous months of 2007. Doing so, we ensure that the effect was not driven by the banks' normal activity, but was instead caused by the higher liquidity shock for European sponsors in the US ABCP market.

Following Acharya et al. (2013), we estimate the baseline specification using heteroskedasticity-consistent standard errors.

6.1.3 Results

Table 3. Banking stock return performance

This table analyzes stock return performance of commercial banks in the United States and Europe, separating between European banks sponsoring conduit vehicles in the US and all other banking institutions.

The dependent variable, “Stock return”, is the cumulative equity return for individual banks, between August 8 and August 10, 2007, calculated using the Return Index on Datastream.

“Dummy” is a binary variable that distinguishes European bank sponsors backing ABCP investment in the US from all other commercial banks in the United States and Europe.

Control variables are as defined in the Appendix.

The sample is restricted to all commercial banks located in the United States and Europe with more than 10 billion dollars in total assets and that have share price data available.

We report heteroskedasticity-consistent standard errors in parentheses; *, **, *** define 1%, 5% and 10% significance.

	Dependent Variable: Stock return (percent)									
	Event Regressions			Placebo Regressions						
	August 8 -10	August 8 - 10	August	January	February	March	April	May	June	July
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dummy	-0.020*** (0.007)	-0.018** (0.008)	-0.026* (0.014)	0.015 (0.019)	0.005 (0.014)	0.027 (0.018)	0.045 (0.038)	0.002 (0.909)	0.016 (0.013)	0.040* (0.022)
Log (Assets)		-0.057** (0.022)	-0.082** (0.038)	0.020 (0.043)	-0.001 (0.026)	-0.033 (0.039)	0.044 (0.044)	-0.011 (0.044)	-0.032 (0.033)	-0.029 (0.048)
Log (Equity)		-0.056** (0.022)	0.102*** (0.038)	-0.039 (0.046)	-0.017 (0.028)	0.014 (0.039)	-0.040 (0.043)	-0.008 (0.045)	0.020 (0.032)	-0.013 (0.051)
Return on assets		-2.148*** (0.784)	-2.195* (1.176)	2.337 (1.596)	1.599 (1.001)	-0.411 (1.355)	1.265 (1.381)	1.484 (1.275)	0.581 (1.137)	3.397 (1.983)
Share short-term debt		0.053 (0.048)	0.059 (0.104)	0.006 (0.101)	0.011 (0.104)	0.072 (0.101)	-0.394 (0.185)	0.177 (0.080)	-0.040 (0.062)	0.011 (0.114)
Share deposits		-0.010 (0.024)	-0.030 (0.043)	0.001 (0.059)	-0.005 (0.044)	-0.015 (0.042)	-0.214 (0.087)	-0.021 (0.038)	0.008 (0.035)	0.036 (0.059)
No. of observations	88	88	88	88	88	88	88	88	88	88
R-squared	0.079	0.219	0.141	0.054	0.100	0.030	0.176	0.115	0.072	0.168

Table 3 presents the results. Column 1 shows that the dummy variable, which distinguishes European bank sponsors backing ABCP investment in the US from all other banking institutions in the sample, is statistically significant at the 1 percent level. On average, the model indicates that the 3-day cumulative return for European banks sponsoring conduit vehicles in the United States was 0.02 percentage points lower than the stock return for all the remaining institutions. On column 2, we control for bank specific characteristics adding bank size – using the natural logarithm of assets and the natural logarithm of equity – return on assets and controls for funding types, including in our regression the share of assets funded with short-term debt and share of assets

funded with deposits. The coefficient of the dummy variable remains at the 0.02 percentage points and is statistically significant, now at the 5 percent level.

We interpret these results as evidence that European banks sponsoring conduit vehicles in the United States were the most affected by the ABCP turmoil since the beginning of the financial crisis. However, and as in Acharya et al. (2013), we argue that the coefficient is most likely to be a conservative estimate of the effects of the early downturn, because investors, responsible for influencing price expectations in the market, could not have quite comprehended the full impact of the ABCP crisis. Also, and considering the relative opaqueness of credit and liquidity guarantees provided to conduit activity, market participants might not have immediately understood that conduit losses would be transferred back onto sponsoring institutions' balance sheets.

Additionally, we estimate the same baseline specification for both August, on column 3, and the previous months of 2007, on columns 4 to 10. We encounter a negative statistical significance at the 10 percent level for our dummy variable and a coefficient of 0,028 percentage points, larger than the estimated for the three-day window period. However, and despite the results appear to indicate that the lag between cumulative returns of European banks sponsoring conduit vehicles in the U.S and all other commercial banks in the United States and Europe was higher for the month of August, we should note that a longer event window may include other factors as confounding effects. Finally, for the months prior to August 2007, we find no statistical significance for our dummy variable, except for July (where the coefficient is statistical significant at the 10 percent level), ensuring that the weaker performance of European bank sponsors backing ABCP investment in the US was in fact driven by currency mismatches in conduit activity.

6.2 Bank sponsors and the Term Auction Facility Program

6.2.1 Data and summary statistics

In order to test whether European commercial banks sponsoring conduit vehicles in the US were the largest beneficiaries of the TAF program, during the period of crisis, we use the US government transaction data for regulatory reform⁸.

Established on December 12, 2007, together with the Credit Swap Lines Liquidity Facility, the TAF program offered an alternative lending mechanism for all US and foreign banks with branches operating in the United States. When conventional monetary policy tools and the discount window borrowing revealed to be insufficient in improving overall economic conditions, the two special aid programs were implemented by the Fed, as a form of providing liquidity to financial institutions in need.

Data on the Federal Reserve's special emergency programs was released on December 1, 2010, as required by the Dodd-Frank Wall Street Reform and Consumer Protection Act.

For each borrowing institution located in the United States and Europe, we aggregate total loan amount for all different auction dates of the TAF lending facility, and use bank location to match the borrower name to the banking institution on Bankscope. Using the Bankscope database, we identify bank type for each borrowing firm, and aggregate commercial banks in the dataset at the level of the parent banking institution. In order to do so, we conduct an online internet search, determining the parent financial company for all banks in the sample. Finally, we identify the banking institutions sponsoring asset-backed commercial paper as of January 1, 2007.

Table 4 presents basic information on the 12 largest borrowers of the TAF lending facility, from the first auction date on December 20, 2007, until March 11, 2010, when the program was terminated.

⁸ Data on all Fed's liquidity and credit programs is available at http://www.federalreserve.gov/newsevents/reform_transaction.htm

Table 4. The twelve largest borrowers of the Fed's Term Auction Facility Program

Data on the TAF lending Program is taken from the Federal Reserve Board of Governors. Equity and conduit data are from Moody's Investors Service and Bankscope database, respectively.

Values are stated in thousands of dollars.

Borrower	Country	Equity	Loan Amount	Average Loan Term	ABCP Outstanding
Bank of America	United States	135 272 000	260 167 000	61,60	45 690 560
Barclays Plc	United Kingdom	53 767 029	227 583 000	42,69	33 451 510
HBOS Plc	United Kingdom	1 161 738 831	173 842 000	56,00	43 900 020
Wells Fargo & Company	United States	481 996 000	146 453 200	48,68	-
Wachovia Corporation	United States	72 817 000	134 525 000	39,74	13 003 470
Société Générale	France	44 348 743	122 377 200	46,29	43 495 030
Dresdner Bank AG	Germany	22 008 429	112 328 200	41,81	23 190 290
Citizens Bank	United States	3 698 340	110 650 000	39,62	-
Citigroup	United States	119 783 000	110 349 700	40,92	92 671 440
Norinchukin Bank	Japan	37 789 204	105 010 000	49,00	3 005 000
Bayerische Landesbank	Germany	16 540 235	101 190 000	34,05	22 351 960
JPMorgan Chase & Co	United States	1 351 520 000	97 500 000	52,71	42 712 940

Of the twelve largest borrowing institutions from the Fed's TAF lending program, represented on table 4, there are ten conduit administrators, sponsoring an aggregate of more than 363 billion dollars in ABCP outstanding. Norinchukin Bank and Bayerische Landesbank, although they were not operating in the commercial banking sector, were also important conduit administrators in early 2007. There are six foreign banks on table 4, four of which are commercial banks operating in European countries.

Overall, there were two hundred eighty-three commercial banks, headquartered in the United States and Europe, that were borrowing from the Federal Reserve. Of those two hundred eighty-two banking institutions, only twenty eight were European banks – accessing the TAF loans through their branches in the US – and twenty of them were European bank sponsors backing conduits' investment in the United States. However, the twenty eight European commercial banks received a total amount of 1 355 billion dollars from the US Federal Reserve, and the European bank sponsors, a value of 1 122 billion dollars, from the aggregate 2 713 billion made available by the TAF program to commercial banks in the United States and Europe.

6.2.2 Methodology

In this subsection, we analyze whether European commercial banks backing conduits' investment in the US received larger loan amounts through the TAF lending program, established by the Federal Reserve. Following Shin (2012), where the author suggests that the use of the Term Auction Facility was an indicator that the borrowing institutions were subjected to important dollar liquidity shortages since the beginning of the crisis, we use a linear regression model in order to test for that hypothesis.

Additionally, we determine if commercial banks with higher conduit exposure were the largest beneficiaries of the TAF lending program. Banks that were providing explicit guarantees to conduit vehicles, as they were the most affected by the ABCP turmoil (Acharya et al., 2013) would benefit the most from the use of the Fed's auction facility.

We estimate the following baseline specification:

$$\text{Log}(\text{loan amount})_i = \beta_1 + \beta_2 D_i + \beta_3 \text{Conduit Exposure}_i + \varepsilon_i$$

where $\text{Log}(\text{loan amount})_i$ is the natural logarithm of total TAF loan amounts received by bank i from the period from December 20, 2007, to March 11, 2010. D_i is a dummy variable equal to 1 if the bank i is an European banking institution sponsoring conduits' investment in the US market, and 0, otherwise, and $\text{Conduit Exposure}_i$, as stated in Acharya et al. (2013), is the ratio of ABCP outstanding to bank equity.

6.2.3 Results

Table 5. Banks borrowing from the Fed’s TAF Program

This table analyzes both if banks with higher exposure to conduit activity and European banks sponsoring conduits’ investment in the United States, received the larger loan amounts through the TAF lending program, established by the Federal Reserve. The dependent variable, “Log(loan amount)”, is the natural logarithm of all TAF loans received by each bank, from December 20, 2007, until March 11, 2010. “Conduit exposure” is measured as the ratio of ABCP outstanding to total equity and “Dummy” is a binary variable that distinguishes European bank sponsors backing ABCP investment in the US from all other banking institutions. Control variables are as defined in the Appendix.

We report standard errors in parentheses; *, **, *** define 1%, 5% and 10% significance.

	Log(loan amount)		
	Event Regressions		
	(1)	(2)	(3)
Dummy	1.779*** (0.264)		1.311*** (0.389)
Conduit Exposure		2.063*** (0.296)	1.012*** (0.345)
No. of observations	283	283	283
R-squared	0.140	0.148	0.174

Table 5 presents the results. Column 1 tests for our main hypothesis, that European banking institutions’ sponsoring conduit vehicles in the US received larger loan amounts through the TAF lending program, established by the Federal Reserve. The results indicate that, on average, and for European bank sponsors backing ABCP investment in the U.S., the natural logarithm of the total TAF loan amount was 1.78 percentage points higher than for all other commercial banks in the sample. The dummy variable on column 1 is statistical significant at the 1 percent level.

On column 2, we show that, on average, an increase of 1 percent on conduit exposure increases the natural logarithm of the total TAF loan amount by 2.06 percentage points. The variable “Conduit Exposure” is statistically significant at the 1 percent level.

Column 3 presents the estimation results. The coefficient for “Conduit Exposure” reduces to 1.31 percentage points, but remains statistically significant at the 1 percent level, and the coefficient of the dummy variable decreases to 1.01 percentage points, continuing to be significant, also at the 1 percent level.

Our results show that not only commercial bank sponsors were the largest beneficiaries of the Term Auction Facility, during the crisis period, but also that European sponsoring institutions which were backing conduits' investment in the US made the most use of the Fed's program. This conclusion is consistent with the results on our first regression analysis, that European commercial banks sponsoring conduit vehicles in the US were the most affected by the financial turmoil. Because of the differences in access to liquidity, with European banks facing extensive difficulties in rolling over their US short-term debts, the TAF lending program, together with the Credit Swap Lines Facility, allowed European bank sponsors to increase their dollar funding, since December, 2007.

7. Conclusion

In this paper, we provide empirical evidence that European banks sponsoring conduit vehicles in the United States were the most affected by the ABCP shock that started on August 9, 2007. We argue that European bank sponsors investing in the US ABCP market faced additional exposure to conduit activity because, in the event that their funding positions could not be rolled over, they had to repay their creditors in non-domestic currency. Thus, at the onset of the financial crisis, when both the interbank and the foreign exchange markets were facing serious disruptions and banks had to tap into alternative funding sources to offset losses on conduit activity, European banks could not increase their dollar funding by as much as they needed. Differently from banks headquartered in the US, that had direct access to the domestic deposits market and to the Federal Home Bank Loans system, foreign banks had to try to raise liquidity in the dollar-denominated wholesales market or by accessing local deposits and exchanging them into US dollars.

We also find that both banking institutions with higher conduit exposure and European banks sponsoring conduits' investment in the US have received the largest loan amounts from the TAF lending program established by the Fed on December 12, 2007. This conclusion is consistent with the results in our first baseline specification, revealing that European bank sponsors investing in the US, as they were facing the highest liquidity shortages since the beginning of the ABCP turmoil, were the most affected by the financial crisis and, therefore, became the most active borrowing participants from the Fed's aid program.

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Appendix A

Table A. Variable definitions

This table defines the variables used throughout our empirical analysis.

Variable	Definition	Source
ABCP outstanding	Total asset-backed commercial paper outstanding	Moody's Investors Service
Conduit exposure	Total asset-backed commercial paper outstanding divided by total equity	Moody's Investors Service, Bankscope
Assets	Total bank assets	Bankscope
Equity	Total bank equity	Bankscope
Return on Assets	Net income divided by total assets	Bankscope
Share short-term debt	Short-term debt divided by total assets	Bankscope
Share deposits	Deposits divided by total assets	Bankscope
Stock return	Total return index (RI)	Datastream